

CLAIMS

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1. A package for an integrated circuit die
comprising:

an integrated circuit die;

5 a plurality of metal contacts adjacent to
peripheral sides of the package;

wherein each contact has a substantially
planar first surface, an opposite substantially
planar second surface, and a side surface between
10 said first and second surfaces;

wherein said first surface has a bond wire
connected thereto, said second surface is exposed
at a first external surface of the package, and
said side surface includes a reentrant portion;

15 and

an encapsulant material which covers the
integrated circuit die and the reentrant portion
of the side surface of each contact.

20 2. The package of claim 1, further comprising:

a die pad having a substantially planar first
surface, an opposite substantially planar second

surface, and a side surface between the first surface and the second surface; and

wherein the side surface of the die pad has a reentrant portion, and the encapsulant material covers the reentrant portion of the side surface of the die pad.

3. The package of claim 2, wherein the second surface of the die pad is exposed at the first external surface of the package.

4. The package of claim 2, wherein the die pad is internal to the package.

5. The package of claim 3, wherein each package has a rectangular perimeter and has four peripheral sides, and said contacts are aligned in a row along two opposite peripheral sides of the package.

6. The package of claim 3, wherein said contacts are aligned in a row along each of the four peripheral sides of the package.

7. The package of claim 3, wherein the side surfaces of the die pad and contacts include a central peak.

8. The package of claim 3, wherein the side surfaces of the die pad and contacts include a central depression.

9. The package of claim 3, wherein the side surfaces of the die pad and contacts include a lip adjacent to the first surface of the die pad and contacts, respectively, and a reentrant orthogonal portion adjacent to said lip.

10. The package of claim 3, wherein the side surfaces of the die pad and contacts include asperities.

11. A package for an integrated circuit die comprising:
an integrated circuit die;

a plurality of metal contacts adjacent to peripheral sides of the package;

wherein each contact has a substantially planar first surface, an opposite substantially planar second surface, and a side surface between
5 said first and second surfaces;

wherein said first surface has a bond wire connected thereto, said second surface is exposed at a first external surface of the package, and
10 said side surface includes a reentrant portion;

a die pad upon which the integrated circuit die is placed, said die pad including a peripheral side surface; and

an encapsulant material which covers the
15 integrated circuit die and the side surfaces of each contact and the die pad; and

wherein the side surface of each contact includes a means for enhancing the connection between the encapsulant material and the contact,
20 and the side surface of the die pad includes a means for enhancing the connection between the encapsulant material and the die pad.

42. A leadframe for making an encapsulated integrated circuit die package comprising:

a frame;

5 a die pad within and connected to the frame, wherein said die pad has a side surface;

a plurality of substantially planar tabs which extend from the frame toward the die pad without contacting the die pad, wherein each tab
10 includes a side surface; and

wherein the side surfaces of the die pad and tabs include a reentrant portion.

13. The leadframe of claim 12, wherein the side
15 surfaces of the die pad and tabs include a central peak.

14. The leadframe of claim 12, wherein the side
surfaces of the die pad and tabs include a central
20 depression.

15. The leadframe of claim 12, wherein the die pad and tabs have a first surface, and the side

surfaces of the die pad and tabs include a lip adjacent to the first surface, and a reentrant orthogonal portion adjacent to said lip.

- 5 16. The leadframe of claim 12, wherein the side surfaces of the die pad and contacts include asperities.

~~17. A leadframe for making a plurality of~~
10 encapsulated integrated circuit die packages comprising:

 a plurality of die pads, wherein each die pad has a side surface;

 a plurality of interconnected frames in a
15 matrix, wherein one of said die pads is within and connected to each of the frames; and

 a plurality of substantially planar tabs which extend from each frame toward the die pad within the particular frame without contacting the
20 die pad; and

 wherein the side surfaces of the die pads and tabs include a reentrant portion.

18. The leadframe of claim 17, wherein the side surfaces of the die pads and tabs include a central peak.

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19. The leadframe of claim 17, wherein the side surfaces of the die pads and tabs include a central depression.

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20. The leadframe of claim 17, wherein the die pads and tabs have a first surface, and the side surfaces of the die pads and tabs include a lip adjacent to said first surface, and a reentrant orthogonal portion adjacent to said lip.

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21. The leadframe of claim 17, wherein the side surfaces of the die pads and contacts include asperities.

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22. A method of making an integrated circuit die package comprising:

providing a substantially planar metal leadframe, said leadframe including a frame;

wherein a substantially planar die pad is within and connected to the frame, and substantially planar tabs extend from the frame toward the die pad without contacting the die pad; and

wherein the die pad and tabs each have a first surface, an opposite second surface, and a side surface, and the side surfaces of the die pad and tabs include a reentrant portion;

placing an integrated circuit die on the first surface of die pad;

electrically connecting the integrated circuit die to the first surface of the tabs;

applying an encapsulant material onto the frame so that the integrated circuit die, the first surfaces of the die pad and tabs, and the side surfaces of the die pad and tabs are covered with the encapsulant material, but the second surfaces of the tabs are not covered;

hardening the encapsulant material; and

cutting the encapsulated frame so that the die pad and tabs are severed from the frame, a

completed package including a die, a die pad, and severed tabs is detached from the leadframe, and said severed tabs are adjacent to peripheral sides of the package.

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23. The method of claim 22, wherein the second surface of the die pad also is not covered with encapsulant material.

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24. The method of claim 23, further including cutting encapsulant material to form the peripheral sides of the package.

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25. The method of claim 24, wherein the cutting is done by sawing.

26. The method of claim 23, further comprising plating the second surfaces of the die pad and tabs with a metal after applying the encapsulant material.

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27. The method of claim 22, further comprising connecting the leadframe to electrical ground.

~~28. A method of making a plurality of integrated~~
circuit packages comprising:

5 providing a substantially planar metal
leadframe, said leadframe including a plurality of
interconnected frames in a matrix;

 wherein a substantially planar die
pad is within and connected to each of
the frames;

10 wherein a plurality of
substantially planar tabs extend from
each frame toward the die pad within the
frame without contacting the die pad;

15 wherein the die pads and tabs each
have first surface, an opposite second
surface, and a peripheral side surface;
and

 wherein the side surfaces of the
die pads and tabs include a reentrant
20 portion;

 placing an integrated circuit die on the
first surface of each die pad;

electrically connecting each integrated circuit die to the first surface of the tabs which extend toward the particular die;

5 applying an encapsulant material onto each of the frames so that the integrated circuit dies, the first surfaces of the die pads and the tabs, and the side surfaces of the die pads and tabs are covered with the encapsulant material, but the second surfaces of the tabs are not covered;

10 hardening the encapsulant material; and

 cutting the encapsulated frames so that the die pads and tabs are severed from their respective frames, a plurality of completed packages each including a die, a die pad, and
15 severed tabs are formed, and the second surfaces of the severed tabs of each package are adjacent to peripheral sides of the package.

29. The method of claim 28, wherein the second
20 surface of the die pad also is not covered with encapsulant material.

30. The method of claim 29, wherein the cutting is done with by sawing.

31. The method of claim 29, further comprising
5 plating the second surfaces of the die pads and tabs with a metal after applying the encapsulant material.

32. The method of claim 28, wherein a single
10 block of encapsulant material covers all of the dies, and further including cutting encapsulant material to form the peripheral sides of the packages.

33. The method of claim 28, wherein each die is within a separate unit of encapsulant material.

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34. The method of claim 28, further comprising connecting the leadframe to electrical ground.

35. A method of making a leadframe comprising:
20 chemically etching a metal sheet to form a frame;
wherein a die pad is within and connected to the frame, tabs extend from the frame toward the

die pad without contacting the die pad, and the die pad and tabs each have a peripheral side surface which includes a reentrant portion.

- 5 36. A method of making a leadframe comprising:
progressively stamping a metal sheet to form
a frame;

10 wherein a die pad is within and connected to
the frame, tabs extend from the frame toward the
die pad without contacting the die pad, and the
die pad and tabs each have a peripheral side
surface which includes a reentrant portion.